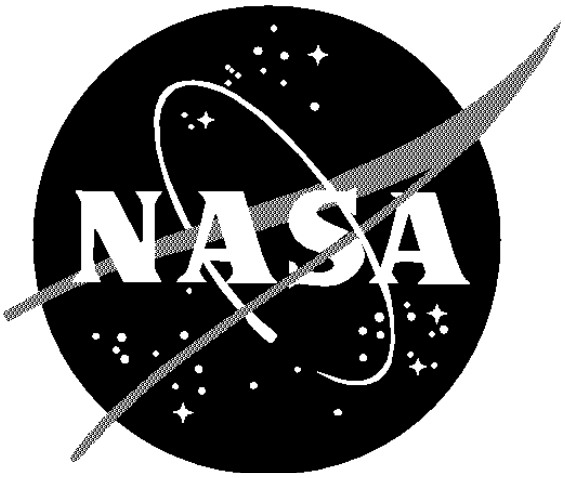

National Aeronautics and Space Administration

Date July 29, 1999

NRA-99-OES-06

RESEARCH ANNOUNCEMENT

LAND COVER AND LAND USE CHANGE RESEARCH

Letters of Intent Due: August 30, 1999

Proposals Due : September 29, 1999

OMB Approval No. 2700-0087

LAND COVER AND LAND USE CHANGE RESEARCH

NASA Research Announcement
Soliciting Research Proposals
for
Period Ending September 29, 1999

NRA 99-OES-06
Issued July 29, 1999

Office of Earth Science
National Aeronautics and Space Administration
Washington, DC 20546

1. Goals of this NASA Research Announcement

This announcement presents an opportunity for researchers to participate in the NASA research and development activity of Land Cover and Land Use Change (LCLUC). LCLUC is an interdisciplinary activity within the NASA Earth Science Enterprise (ESE) program structure and supports one of the priority research areas identified by the US Global Change Research Program (USGCRP). ESE is NASA's enterprise to study the Earth as an integrated system, emphasizing observations made from the unique perspective of space together with underlying laboratory, field, theoretical, and modeling research. The ESE has established the following research themes as priorities for the research program: biology and biogeochemistry of ecosystems and the global carbon cycle, the global water and energy cycle, climate variability and prediction, atmospheric chemistry, and solid Earth science. In addition, the ESE fosters applications research and commercial developments aimed at more pragmatic issues including: food and fiber, natural resources, disaster management, environmental quality, urban systems and infrastructure, and human health and safety.

One of the three key scientific questions within the theme of biology and biogeochemistry of ecosystems and the global carbon cycle focuses on understanding how land cover and land use are changing and what are the causes and consequences of such changes. Another of the key questions focuses on the role of ecosystems in the global carbon cycle. LCLUC aims to develop and use NASA remote sensing technology to address these issues and improve our understanding of human interaction with the terrestrial environment. This improved understanding will be used to provide a foundation for sustainable use and management of our natural resources.

The purpose of this NASA Research Announcement (NRA) is to solicit scientific investigations on the topic of land cover and land use change that combine remotely-sensed data with information and knowledge from other sources. The scope of this NRA will be directed at two important elements of the LCLUC Program: 1) Human and natural disturbance and the implications for carbon dynamics and 2) Development of remote sensing techniques and data sets that could lead to operational forest monitoring systems.

2. Background

There are very few landscapes on Earth that have not been significantly altered or are not being altered by humans. The current pattern of land cover most often reflects past and present land use. The larger patterns of land cover are observable and can be monitored from space. From historical archives, including the last twenty years of satellite data, one can build a quantitative assessment of landscape and land use change. More subtle types of change which take place, for example, through intensification of human use, require additional *in-situ* information.

Changes in land cover and land use have impacts and implications at local, regional and global scales because of the way they alter biophysical, biogeochemical and hydrological states and processes. In the future, increasing pressure for land and food will lead to changes in land cover and land use and associated ecosystem processes in ways that currently cannot be well predicted.

The driving forces of land cover and land use change arise from a combination of socioeconomic and physical factors. These factors are often poorly understood and modeled by the scientific community. A better understanding of the factors controlling land cover and land use change will

improve the development of models, which can then be used to evaluate various options for improved land use and management.

The Land Cover and Land Use Change Program seeks to provide the underlying science to permit assessments of the current distribution of land cover and land use, the changes that have taken place in the last several decades, the impact of those changes on biogeochemical cycling, biophysical processes, biodiversity, trace gas and particulate fluxes, and the likely impacts of future land cover change. It addresses scientific questions relevant to and in some cases critical for sustainable land management and provision of ecological goods and services.
The ultimate vision of the LCLUC program is to develop the capability to perform repeated global inventories of land use and land cover from space, and to develop the scientific understanding and models necessary to simulate the processes taking place, and evaluate the consequences of observed and predicted changes. The underlying philosophy of the ESE LCLUC Program is to further the understanding of the consequences of land cover and land use change on ecosystem state and processes for continued provision of ecological goods and services.

NASA recognizes the importance of coupling the research efforts in land use and land cover change to existing NASA research programs, remote sensing platforms, instruments that are already in place, and new instruments that are being developed, in order to take best advantage of existing program investments, e.g. the NASA Earth Observing System (EOS) and EOS interdisciplinary science (IDS) programs, the NASA Research and Applications programs, the NASA EOS Pathfinder Projects, and new commercial sources of high resolution data. At the same time, it is important to lay the plans for new campaigns and research topics, while exploring the opportunities for the development of new technologies and measurement capabilities. For example, NASA's new Scientific Data Buy will make available commercial remote sensing data relevant to the study of land cover and land use change (see http://www.crsp.ssc.nasa.gov/databuy/ -- if such data are to be requested, they should be identified in a proposer's budget). It is of critical importance to develop links to research and operational programs involved with similar topics within other US government agencies, and research in scientific and operational agencies around the world through collaborative projects. NASA's LCLUC recognizes the importance of the National and Regional Assessment Program of USGCRP and the potential contribution from the regional LCLUC case studies. LCLUC also recognizes that the international scientific community, through the International Geosphere-Biosphere Programme (IGBP), World Climate Research Programme (WCRP) and International Human Dimensions Programme (IHDP) provide important forums for international research program design and coordination. The IGBP and IHDP have created a joint Core Project called Land Use and Cover Change (LUCC) to address important land cover and land use change issues.

Recognizing the importance of developing operational systems for satellite data provision, the Committee on Earth Observation Satellites (CEOS) has initiated a small number of ‘operational pilot’ projects. The Global Observation of Forest Cover (GOFC) Pilot Project has as its goal to develop operational systems for forest cover monitoring. These systems would provide data that would serve the needs of the global change science community, the forest management community and policy makers. LCLUC intends to make a contribution to GOFC through this research announcement by developing techniques, algorithms, methods, and data sets needed for eventual operational monitoring of forest cover.

In developing the program elements and establishing a role with respect to other parts of the USGCRP, LCLUC provides the following three guidelines for proposers:

- *The NASA Land Cover and Land Use Change program will rely primarily on existing components of ESE and national and international science agencies for the development of historical land cover, land use and climatic data sets.*

- *The NASA program will investigate the human dimension processes directly when they are coupled to observed recent changes in the landscape or regional predictive models.*

- *The LCLUC program encourages P.I.'s involved in international research to develop active collaboration with regional scientists and experts from the countries involved. These collaborations should be mutually beneficial, strengthening the LCLUC research teams and helping promote the LUCC research agenda in the international arena.*

There is increasing emphasis on forestry and agriculture in temperate and boreal systems, as the implications of the Climate and Biodiversity Conventions for forests and agriculture become better understood by individual countries. Through the LCLUC program, there are strong opportunities for the NASA program to develop interactions with a variety of regional case studies, as well as with other US programs in the land management and development agencies. These links will be especially important in building up the history of land management in particular case studies. The primary consideration of the location of the *in-situ* research will be to have sites representative of the major land cover and land use types identified in the initial studies of land cover conversion, as well as those areas undergoing intensification of management activities.

3. Priority Topical Areas for this NRA.

Two areas of research have been identified for this announcement:

a) Human and natural disturbance and implications for carbon dynamics.

The current pattern of land cover is related in part to the disturbance regimes that have operated or are operating on the landscape. Ecosystems and land management systems have adapted to the disturbance regimes to which they are commonly exposed. Disturbance regimes occur over a range of spatial and temporal scales and play an important role in biogeochemical cycling and biophysical processes. Disturbance is often an integral part of ecosystem functioning but is generally poorly represented in ecosystem process models. Climate variability and human land use can influence the disturbance regimes operating on a landscape and there are potentially complex feedbacks between disturbance, climate and land use. Some patterns of disturbance are detectable and measurable by remote sensing. The development of spatially explicit and dynamic models of disturbance linked to biogeochemical and biophysical process models is an emerging component of the program. As with the other components, emphasis is given to regional scale analyses. It is anticipated that two to five proposals in the range of $100-200Kwill be funded in response to this NRA in this topical area

The LCLUC Program is requesting proposals that address the development of methods and datasets for exploring the pattern of disturbance and the response of ecosystems to human and

natural disturbances. These proposals should give emphasis to understanding the implications of disturbance for carbon dynamics. Proposers are encouraged to submit research proposals that address human induced and natural disturbance, incorporate the use of remotely sensed data or provide an improved understanding of measurement techniques and requirements needed to improve current of future satellite based monitoring of disturbance.

b) Developing Forest Monitoring Systems

Proposals are sought that contribute to the goals of the emerging CEOS Global Observation of Forest Cover (GOFC) Project. GOFC is an operational pilot project designed to provide data to a number of user communities concerned with forest cover monitoring. The GOFC program is being undertaken in the context of the growing need by the science and policy communities for timely and reproducible data sets on forest extent, rates of change and biophysical characteristics. The policy interest in forest monitoring is increasing through developments in the Framework Convention on Climate and the Biodiversity Convention. The GOFC design document is available on the WWW at http://lcluc.gecp.virginia.edu/ . The GOFC WWW site can be found at http://www.gofc.org/gofc **.** It is anticipated that five to ten proposals in the range of 100-200K will be funded in response to this topical area of the NRA.

In this particular announcement, the LCLUC program will entertain proposals that develop monitoring techniques, algorithms and data sets that focus on the global change science, biodiversity or sustainable forest management needs for operational monitoring of forest cover. Emphasis will be given to data sets produced at regional to global scales and in areas of rapid land cover change. Proposals are encouraged that combine data from multiple data sources to generate enhanced information. In particular integration of multiple sources of satellite data and in situ data is encouraged. Attention should be given to the means by which the output data will be validated, documented, managed and made available to other GOFC partners and data users. Proposals must apply the data to specific global change research questions or make explicit linkages to users of the resulting data products. Proposals that address the means and mechanisms to develop the transfer of data set production from research to operational mode are encouraged. Regional studies should develop partnerships with individuals or institutions from the region of study.

4. Reporting and Science Team Activities

The Land Cover/Land Use Change Program will develop a series of reports that identify the consequences of land use change in globally important areas of rapid change, and these reports will provide the scientific foundation for a new NASA series of reports on human influences on the biosphere.

The investigators selected through this NRA, will join the Land Cover and Land Use Change Science Team which includes selected investigators from other peer-reviewed projects and programs within ESE and appropriate programs in other Federal agencies. The Science Team will meet at least once a year as a whole to review progress, report results, and advise ESE on new research directions. In addition, the Science Team will be expected to advise NASA on a variety of research topics related to land cover and land use change. For example, the Science Team might be asked to evaluate the degree to which land surface classification algorithms for

research and operational purposes ought to be synchronized, or whether new instrument proposals will meet LCLUC data needs.
Specific charges to the Science Team will be to:

1) develop a series of reports and assessments on the consequences of land use change in different parts of the globe. These reports will go beyond the expected high number of scientific refereed papers from this program and will be targeted at high-level decision-makers and the public. The reports will be along the lines of integrated assessments closely tying the science to improved resource and environmental management.
2) contribute to the LCLUC WWW Site providing a specific links, which describes their research, presents results and gives access to copies of data sets generated though their project.

5. Guidance for Proposers

Eligibility

Participation in the LCLUC program is open to all categories of domestic and foreign organizations, including educational institutions, industry, non-profit institutions, NASA research centers, and other government agencies and laboratories (including Federally Funded Research and Development Centers). Participation by non-U.S. institutions is strongly encouraged within the specific guidelines described in Appendix B, which include a no-exchange-of-funds provision.

Proposal Submission and Review

Letter of Intent
Proposers are requested to submit a letter of intent describing their interest in proposing to this announcement and describing the topic of the research. The format and processes for submitting the letter of intent are found in Appendix D.

Page Limits
Proposals may be a maximum of fifteen pages of text, single-spaced, 12-pt. type, including references. Additional pages to be included are: a single cover page with the research title, name and contact information of the Principal Investigator(s) and any Co-investigators, a detailed cost plan (3-8 pages); a two page (maximum) management plan; a two page (maximum) vitae for each P.I. and Co-I.; a one to two page summary of current and pending research funding including proposal name, funding agency, duration, and total funding; and up to two pages of figures and tables may also be appended.

Review Process
Proposals will be mailed to at least three independent peer reviewers who will be asked to evaluate them.. A peer review panel may also be convened as part of the process. Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission, as identified in this NRA. Evaluation of its intrinsic merit includes the consideration of the factors listed in Appendix A Item (i).

NASA reserves the right to select and make an award covering a portion of the proposed investigation subject to the consent of the investigator. Final decisions will be made promptly and investigators will be notified through both electronic mail and surface mail. Proposers will receive anonymous copies of review comments on request.

Period of Performance
Proposals will be considered for periods of performance from one to three years Projects may be partially funded within fiscal years to minimize uncosted carry over. NASA anticipates annual funding of this NRA at $1.5Mwith approximately 7-15 awards with annual budgets in the $100K-$200K range. Because of the cross-disciplinary nature of the NRA, proposers should budget for one team meeting per year, to be held in the Washington, DC area.

Additional Information
Appendix A contains the basic guidance needed for preparation of proposals in response to this NASA Research Announcement. Appendix B provides guidance for international participation. Appendix C provides the list of required declarations and the required proposal cover sheet. Appendix D has information on submitting a letter of intent (LOI), which is desired, but not required. Appendix E has a standardized budget sheet that should be used for each year covered by the proposal. Appendix F provides the URL addresses for accessing home pages with information relevant to this NRA on-line via electronic networks. If electronic access is not available to the prospective proposers, a hard copy of relevant reference(s) can be requested through the points of contact identified below Appendix G provides further background information about the Land Cover Land Use Program.

Submit Proposals to:
LAND COVER AND LAND USE CHANGE RESEARCH
Code Y
400 Virginia Avenue, SW, Suite 700
Washington, DC 20024

Copies required: 10

Selecting Official: Director, Research Division
Office of Earth Science
To obtain additional general information:
K. Jon Ranson,
Acting Program Manager, Land Cover and Land Use Change
Code YS
300 E St., SW
Washington, DC 20546
Phone: 202-358-0276
Fax: 202-358-2771
Email: jranson@hq.nasa.gov

Your interest and cooperation in participating in this opportunity are appreciated.

Ghassem R. Asrar
Associate Administrator for
Office of Earth Science

Enclosures:

Appendix A, "Instructions for Responding to NASA Research Announcements"
Appendix B, "Guidelines for International Proposals"
Appendix C, "Required Declarations and proposal Cover Sheet"
Appendix D, Letter of Intent,
Appendix E, Budget Information
Appendix F, "Electronic Addresses"
Appendix G, Program Elements of LCLUC

Appendix A

INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS

Part 1852.235-72
NASA Federal Acquisition Regulations (FAR) Supplement (NFS) Version 89.90, Effective March 11, 1997.

Accessible at URL http://www.hq.nasa.gov/office/procurement/regs/nfstoc.htm
Open Part 1852.228 to 1852.241 from menu.

(JANUARY 1997)

(a) General.

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.

(2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

(3) NRAs contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRAs.

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate instrument. Contracts resulting from NRAs are subject to the Federal Acquisition Regulation and the NASA FAR. Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRAs; however, it is requested that proposals conform to the guidelines in these instructions. NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

(6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

(b) NRA-Specific Items. Several proposal submission items appear in the NRA itself: the unique NRA identifier; when to submit proposals; where to send proposals; number of copies required; and sources for more information. Items included in these instructions may be supplemented by the NRA.

(c) The following information is needed to permit consideration in an objective manner. NRAs will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) Transmittal Letter or Prefatory Material.

(i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;

(ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;

(iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;

(iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;

(v) Identification of other organizations that are currently evaluating a proposal for the same efforts;

(vi) Identification of the NRA, by number and title, to which the proposal is responding;

(vii) Dollar amount requested, desired starting date, and duration of project;

(viii) Date of submission; and

(ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

(2) Restriction on Use and Disclosure of Proposal Information. Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to maximize protection of trade secrets or other information that is confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

Notice

Restriction on Use and Disclosure of Proposal Information

The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

(3**) Abstract**. Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach.

(4**) Project Description**.

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

(5) **Management Approach**. For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) **Personnel**. The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) **Facilities and Equipment**.

(i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Include evidence of its availability and the cognizant Government points of contact.

(ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non-research purposes should be explained.

(8) **Proposed Costs**.

(i) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

(ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.

(iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

(9) **Security**. Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.

(10) **Current Support**. For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

(11) **Special Matters**.

(i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(ii) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

(d) **Renewal Proposals**

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

(2) NASA may renew an effort either through amendment of an existing contract or by a new award.

(e**) Length**. Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

(f) **Joint Proposals**.

(1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

(2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

(g) **Late Proposals**. A proposal or modification received after the date or dates specified in an NRA may be considered if doing so is in the best interests of the Government.

(h) **Withdrawal**. Proposals may be withdrawn by the proposer at any time before award. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

(i) **Evaluation Factors**

(1) Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

(2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

(3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:

(i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.

(ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.

(iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.

(iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.

(4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

(j) **Evaluation Techniques**. Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within NASA. In all cases proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.

(k**) Selection for Award**.

(1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.

(2) When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation. The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.

(l) **Cancellation of NRA**. NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.

APPENDIX B

GUIDELINES FOR FOREIGN PARTICIPATION

NASA accepts proposals from entities located outside the U.S. in response to this NRA. Proposals from non-U.S. entities should not include a cost plan. Non-U.S. proposals, and U.S. Proposals that include non-U.S. participation, must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the non-U.S. participant is proposing. Such endorsement should indicate the following points: (1) The proposal merits careful consideration by NASA; and (2) If the proposal is selected, sufficient funds will be made available by the sponsoring foreign agency to undertake the activity as proposed.

Proposals, along with the requested number of copies and Letter of Endorsement must be forwarded to NASA in time to arrive before the deadline established for this NRA. In addition, **one** copy of each of these documents should be sent to:

NASA Headquarters
Office of External Relations
Office of Earth Science Division
Mail Code IY
Washington, DC 20546
USA

Any materials sent by courier or express mail (e.g., Federal Express) should be sent to:

NASA Headquarters
Office of External Relations
Office of Earth Science Division
Mail Code IY
300 E Street, SW
Washington, DC 20024-3210

All proposals must be typewritten in English. All non-U.S. proposals will undergo the same evaluation and selection process as those originating in the U.S. Non-U.S. proposals and U.S. Proposals that include non-U.S. participation, must follow all other guidelines and requirements described in this NRA. Sponsoring non-U.S. agencies may, in exceptional situations, forward a proposal without endorsement to the above address, if review and endorsement are not possible before the announced closing date. In such cases, however, NASA's Earth Science Division of the Office of External Relations should be advised when a decision on the endorsement is to be expected.

Successful and unsuccessful proposers will be contacted directly by the NASA Program Office coordinating the NRA. Copies of these letters will be sent to the sponsoring government agency.

Appendix C

Proposal Cover Sheet

NASA Research Announcement 99-OES-06
Proposal No. _____ (Leave Blank for NASA Use)

Title: _____

Principal Investigator::_____

Department:_____

Institution: _____

Street/PO Box: _____

City: _____ State: _____ Zip: _____

Country: _____ E-mail: _____

Telephone: _____ Fax: _____

Co-Investigators:

Name	Institution & Email Address	Telephone & Address
_____	_____	_____
_____	_____	_____
_____	_____	_____

Budget:
1st Year: _____ 2nd Year: _____ 3rd Year: _____ Total: _____

Certification of Compliance with Applicable Executive Orders and U.S. Code

By submitting the proposal identified in this *Cover Sheet/Proposal Summary* in response to this Research Announcement, the Authorizing Official of the proposing institution (or the individual proposer if there is no proposing institution) as identified below:

- certifies that the statements made in this proposal are true and complete to the best of his/her knowledge;
- agrees to accept the obligations to comply with NASA award terms and conditions if an award is made as a result of this proposal; and
- confirms compliance with all provisions, rules, and stipulations set forth in the two Certifications contained in this NRA [namely, (i*) Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs, and (ii) Certifications, Disclosures, And Assurances Regarding Lobbying and Debarment & Suspension*].

Willful provision of false information in this proposal and/or its supporting documents, or in reports required under an ensuing award, is a criminal offense (U.S. Code, Title 18, Section 1001).

Title of Authorizing Institutional Official: _____

Signature: _____ Date: _____

Name of Proposing Institution: _____

Telephone: _____ E-mail: _____ Facsimile: _____

Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs

The *(Institution, corporation, firm, or other organization on whose behalf this assurance is signed, hereinafter called "Applicant ")* hereby agrees that it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1962 (20 U.S.C. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and the Age Discrimination Act of 1975 (42 U.S.C. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and hereby give assurance that it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which the federal financial assistance is extended to it by NASA.

this assurance is given in consideration of and for the purpose of obtaining any and all federal grants, loans, contracts, property, discounts, or other federal financial assistance extended after the date hereof to the Applicant by NASA, including installment payments after such date on account of applications for federal financial assistance which were approved before such date. The Applicant recognized and agrees that such federal financial assistance will be extended in reliance on the representations and agreements made in this assurance, and that the United States shall have the right to seek judicial enforcement of this assurance. This assurance is binding on the Applicant, its successors, transferees, and assignees, and the person or persons whose signatures appear below are authorized to sign on behalf of the Applicant.

NASA FORM 1206

CERTIFICATIONS, DISCLOSURES, AND ASSURANCES
REGARDING LOBBYING AND DEBARMENT & SUSPENSION

1. LOBBYING

As required by Section 1352, Title 31 of the U.S. Code, and implemented at 14 CFR Part 1271, as defined at 14 CFR Subparts 1271.110 and 1260.117, with each submission that initiates agency consideration of such applicant for award of a Federal contract, grant, or cooperative agreement exceeding $ 100,000, the applicant must **certify** that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit a Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

2. GOVERNMENTWIDE DEBARMENT AND SUSPENSION

As required by Executive Order 12549, and implemented at 14 CFR 1260.510, for prospective participants in primary covered transactions, as defined at 14 CFR Subparts 1265.510 and 1260.117—

(1) The prospective primary participant **certifies** to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency.

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (l)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

(2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

APPENDIX D

Letter of Intent

All prospective proposers are strongly encouraged to submit a letter of intent in response to this announcement. This will allow us to alert a peer review staff to adequately cover the proposal review process. This letter of intent is available electronically via the Internet at URL: http://www.earth.nasa.gov/nra/index.html. We urge you to use these electronic letter of intent forms unless you do not have access to the Internet. In that case, we will accept a FAX copy sent to 202-554-3024 with the following information:

PI and CoI names and addresses, (including Zip + 4);
Title of proposal;
Telephone number;
Fax number;
Email address; and
A brief summary of what you plan to propose (Please limit this to no more than 3000 characters).

APPENDIX E

BUDGET SUMMARY

For period from _____ to _____

- Provide a complete Budget Summary for year one and separate estimated for each subsequent year.
- Enter the proposed estimated costs in Column A (Columns B & C for NASA use only).
- Provide as attachments detailed computations of all estimates in each cost category with narratives as required to fully explain each proposed cost. See *Instructions For Budget Summary* on following page for details.

		NASA USE ONLY	
	A	**B**	**C**
1. Direct Labor (salaries, wages, and fringe benefits)	_____	_____	_____
2. Other Direct Costs:			
a. Subcontracts	_____	_____	_____
b. Consultants	_____	_____	_____
c. Equipment	_____	_____	_____
d. Supplies	_____	_____	_____
e. Travel	_____	_____	_____
f. Other	_____	_____	_____
3. Facilities and Administrative Costs	_____	_____	_____
4. Other Applicable Costs:	_____	_____	_____
5. SUBTOTAL--Estimated Costs	_____	_____	_____
6. Less Proposed Cost Sharing (if any)	_____	_____	_____
7. Carryover Funds (if any)			
a. Anticipated amount : _____			
b. Amount used to reduce budget	_____	_____	_____
8. Total Estimated Costs	_____	_____	XXXXXXX
9. APPROVED BUDGET	XXXXXX	XXXXXXX	_____

INSTRUCTIONS FOR BUDGET SUMMARY

1. Direct Labor (salaries, wages, and fringe benefits): Attachments should list the number and titles of personnel, amounts of time to be devoted to the grant, and rates of pay.

2. Other Direct Costs:
    a. Subcontracts: Attachments should describe the work to be subcontracted, estimated amount, recipient (if known), and the reason for subcontracting.
    b. Consultants: Identify consultants to be used, why they are necessary, the time they will spend on the project, and rates of pay (not to exceed the equivalent of the daily rate for Level IV of the Executive Schedule, exclusive of expenses and indirect costs).
    c. Equipment: List separately. Explain the need for items costing more than $5,000. Describe basis for estimated cost. General purpose equipment is not allowable as a direct cost unless specifically approved by the NASA Grant Officer. Any equipment purchase requested to be made as a direct charge under this award must include the equipment description, how it will be used in the conduct of the basic research proposed and why it cannot be purchased with indirect funds.
    d. Supplies: Provide general categories of needed supplies, the method of acquisition, and the estimated cost.
    e. Travel: Describe the purpose of the proposed travel in relation to the grant and provide the basis of estimate, including information on destination and number of travelers where known.
    f. Other: Enter the total of direct costs not covered by 2a through 2e. Attach an itemized list explaining the need for each item and the basis for the estimate.

3. Facilities and Administrative (F&A) Costs: Identify F&A cost rate(s) and base(s) as approved by the cognizant Federal agency, including the effective period of the rate. Provide the name, address, and telephone number of the Federal agency official having cognizance. If unapproved rates are used, explain why, and include the computational basis for the indirect expense pool and corresponding allocation base for each rate.

4. Other Applicable Costs: Enter total explaining the need for each item.

5. Subtotal-Estimated Costs: Enter the sum of items 1 through 4.

6. Less Proposed Cost Sharing (if any): Enter any amount proposed. If cost sharing is based on specific cost items, identify each item and amount in an attachment.

7. Carryover Funds (if any): Enter the dollar amount of any funds expected to be available for carryover from the prior budget period Identify how the funds will be used if they are not used to reduce the budget. NASA officials will decide whether to use all or part of the anticipated carryover to reduce the budget (not applicable to 2nd-year and subsequent-year budgets submitted for award of a multiple year award).

8. Total Estimated Costs: Enter the total after subtracting items 6 and 7b from item 5.

APPENDIX F

The home pages listed below provide further information relevant to this NRA and Office of Earth Science:

(1) NASA ESE Home Page http://www.earth.nasa.gov/

(2) EOS Project Science Office Home Page http://eospso.gsfc.nasa.gov/

(3) The LCLUC web site is located at http://lcluc.gecp.virginia.edu/.

(4) This and other NASA Research Announcements can be found at http://www.earth.nasa.gov/nra/current/index.html

(5**)** NASA's new Scientific Data Buy makes available certain commercial remote sensing data relevant to the study of land cover and land use (if such data are to be requested, they should be identified in a proposer's budget) http://www.crsp.ssc.nasa.gov/databuy/

Appendix G

Program Elements of LCLUC

There are four major underlying research dimensions to the NASA ESE Land Cover and Land Use Change Program. A short description is provided of the emphasis that NASA's program currently has in each:

A) Forcing Factors

These are the factors that drive changes in landscapes and the resultant impacts on the biogeochemical and hydrological cycles and energy and gas fluxes. They can be broadly separated into climatic and ecological factors and socioeconomic factors, which may interact. These forcing factors are manifested through different agents of land cover change such as fire, drought, flooding, insects and disease, logging and land clearing**.**

(1) Climatic and ecological drivers:
Short and long-term variability in weather, climate, and internal ecosystem dynamics drive some aspects of land cover and land use change on decadal and multidecadal time scales. Interannual variability in climatic extremes can act as a catalyst for land cover change; for example successive years of drought can change ecosystem composition as well as land use. Similarly changes in climate may result in changes in disturbance regimes. These drivers must be taken into account in any attempt to understand current patterns of land cover and land use, and also must be taken into account in any attempts at predicting trends.

(2) Socioeconomic drivers:
Economic, social, and political factors fuel human activities responsible both for conversion of land cover and for changes in land-management regimes. Population dynamics and economic activity are clearly major factors in the determining the distribution and intensity of land cover change. Pressures around the world for economic development, and the need for increased food production and delivery must be quantified, understood, and ultimately modeled. Any attempt to understand current patterns of land cover and land use must explicitly take into account land use history. The ESE program will be linked to other research on human dimensions of land use change both within the US and abroad. This coupling will enable a more complete understanding of human and physical factors in determining the extent, rate, and consequences of land cover and land use change.

B) Responses and Consequences

There are three broad categories of response to the drivers of change, which are of particular importance to the NASA program: land cover conversion, land use intensification, and land degradation. The consequences of land cover and land use change are diverse and can affect biogeochemical cycling, biophysical processes, biodiversity and the maintenance of ecological systems. NASA proposes to focus its effort initially in those parts of the world that are currently undergoing the most stress, that is, where major changes are already taking place, and where the impacts from human activities are sure to increase most rapidly.

(1) Land cover conversion: *A primary NASA interest is to identify the current distribution of land cover, and to track changes in land cover characteristics and conversion to other types. Measurement of the rates of rapid conversion of forest cover to other types, as is occurring in the humid tropics, is of particular interest to this program because of the links to the carbon cycle, trace gas emissions, biodiversity, and sustainable development.*

Data on the distribution and rates of change in land cover can be used in the development and verification of biogeochemical and biophysical models, in the analysis of the effect of spatial patterns and history of conversion on ecosystem processes and structure, on the effects on biodiversity at a variety of scales of analysis, and on the effects on the continued delivery of ecological services on local-landscape-regional scales. These data will additionally be critical to identifying the types of land cover in which *in situ* process and ecosystem studies need to be performed in order to parameterize landscape-scale (and larger) ecosystem models, and to understand the current patterns of biogeochemical and biophysical functioning. Data on land cover and land cover change are also needed to estimate parameters(e.g., albedo, evapotranspiration, surface roughness) for global climate models**.** Links to patterns and changes in tropospheric chemistry and possible changes in large-scale hydrometeorology can also be explored in this arena.

(2) Land use intensification: *An interest of the NASA Land Cover and Land Use Change program will be in understanding the extent and consequences of intensified management of agricultural, agroforestry, and grazing systems, particularly in the tropics and sub-tropics on biogeochemical and nutrient cycling.*
Intensification of land use provides a means to reduce the pressure for land conversion. A combination of in-situ measurements and satellite observations may be needed to quantify land use intensity. Research is needed to determine managed land use types and intensity from remotely sensed data alone. Indirect determination of land use type through land cover measurements requires method development. Hyperspatial resolution data may provide a means to directly determine land use.

(3) Land degradation: *Inappropriate use of land can result in land degradation or a decrease in the production potential of the land. The LCLUC program is interested in being able to measure and monitor the extent of land degradation and understand its effect on productivity and carbon cycling.*
Satellite data can help scientists understand the consequences of managing the end-states of land cover change. Detecting degradation of forest resources by satellite is difficult. For example, research by the Landsat Pathfinder Humid Tropical Forest Project suggests that while Landsat can be used to detect the presence of intensive logging, additional methodological and technological research may be necessary to arrive at consistent and replicable regional estimates of long-term degradation. There is some hope however, that microwave or laser data will allow the identification of changes in forest structure resulting from selective logging or harvesting. Quantifying phenomena such as long-term change in the frequency of fire in forests or savannas will require both good historical data, and improvements in satellite measurement techniques.

C) Modeling and Implications

The Land Cover and Land Use Change Program will develop techniques to incorporate land cover and land use change in biogeochemical and biophysical models. It will support research to

enhance the parameterization or validation of numerical models through the use of remotely sensed data and derived products. It is important to be able to develop, parameterize, and evaluate models that are able to couple the biogeochemical and biophysical dynamics of the land surface and its interactions with the atmosphere with land use and land cover change.

Ultimately, it will be the ability to model systems undergoing land use change that will provide tools for both scientists and decision-makers to evaluate the potential consequences of different management practices, and to assess the consequences of policies that affect land cover conversion. There will be close ties of the Land Cover and Land Use Change Program to the existing and developing efforts in Earth System Modeling, sponsored through ESE Science and the NASA EOS Interdisciplinary Science teams. The project will also link to the modeling activities of the IGBP GCTE (Global Carbon and Terrestrial Ecosystems), IGAC (International Global Atmospheric Chemistry), and LUCC Core Projects and encourage coordinated community model intercomparison activities**.**

D) Techniques and Methods

The LCLUC supports developing, refining and implementing techniques and methods in support of the science objectives of the LCLUC program. These systems need to include data management approaches that provide timely access to data. Techniques and methods for applying satellite data to address questions of land cover and land use change are being developed in various parts of current NASA programs. Close coordination is sought between LCLUC and the algorithm development and testing which is being supported by the remote sensing science component of the NASA Terrestrial Ecology Program, with the NASA Pathfinder Program, and with EOS Interdisciplinary Science and Instrument Science Teams. Synergies will be encouraged between LCLUC and the data management initiatives of EOSDIS and the Earth Science Information Partnerships.

The 25-year record of high-resolution Landsat data provides an important foundation for development of a land cover monitoring system. The Advanced Very High Resolution Radiometer (AVHRR) 1km global data set also provides an important source of data for global land cover classification and direct parameterization of land cover. SeaWiFs and the Vegetation Instrument on-board SPOT 4 satellites may provide new sources of 1 km data. In addition to utilizing data from the current and historic sensors, over the next several years, the contributions of Earth Observing Systen (EOS) Terra (formerly AM-1), EOS PM, Earth Observer (EO) 1, Vegetation Canopy Lidar (VCL) , Landsat-7, and proposed radars and hyperspatial resolution optical sensors will become critical to the continued success of the proposed research program. These missions will be expected to provide quantitative, space-based data on land surface characteristics, climatic regimes and underlying vegetation dynamics around the world.

4. Evolution of the LCLUC Program

In the first NRA issued in July 1996 a number of regional land cover and land use case studies were selected which combined physical and socioeconomic data and models. Emphasis was given to areas of rapid recent land use and land cover change. In addition a small number of proposals were selected addressing priority data sets for LCLUC analysis which were not part of

the NASA Land Pathfinder Program. In a subsequent NRA associated with the Large Scale Biosphere-Atmosphere Experiment in Amazonia (LBA), a number of LCLUC proposals were selected. Descriptions of these existing LCLUC Projects are available on the WWW at http://lcluc.gecp.virginia.edu/. This NRA seeks to supplement the Program efforts in Human and Natural Disturbances and initiate activities toward use of satellite data for global observation of forest cover as described in the body of the text.